1. A race car accelerates from rest to a speed of 287 km/h in 6.8 seconds. What is its average acceleration?

\[ a = \frac{v}{t} = \frac{287 \text{ km/h}}{6.8 \text{ s}} = 42.4 \text{ m/s}^2 \]

2. The space shuttle undergoes an acceleration of 53.9 m/s\(^2\). How fast is it traveling at the end of 55.2 s?

\[ v = at = (53.9 \text{ m/s}^2)(55.2 \text{ s}) = 3000 \text{ m/s} \]

3. Can an object under constant acceleration come to rest and stay at rest? Explain your answer.

4. You are in an elevator that is accelerating you upward at 4.55 m/s\(^2\). How much time till you are traveling at 11.0 m/s?

\[ t = \frac{v}{a} = \frac{11.0 \text{ m/s}}{4.55 \text{ m/s}^2} = 2.42 \text{ s} \]

5. Two cars travel in the same direction along a straight highway, one at a constant speed of 55 mi/h and the other at 70.0 mi/h. (a) Assuming that they start at the same point, how much sooner does the faster car arrive at a destination 10. miles away? (b) How far must the faster car travel before it has a 15 minute lead on the slower car?

(a) \[ t_1 = 10 \text{ mi} \left( \frac{1 \text{ hour}}{70 \text{ mi/h}} \right) = 0.143 \text{ h} \]
\[ t_2 = 10 \text{ mi} \left( \frac{1 \text{ hour}}{55 \text{ mi/h}} \right) = 0.182 \text{ h} \]

Time difference: \(0.182 \text{ h} - 0.143 \text{ h} = 0.039 \text{ h}\)

(b) 15 min lead -- ahead by distance equal to that traveled by slower car in 15 min.

\[ 15 \text{ mi/h} \left( \frac{1 \text{ h}}{60 \text{ min}} \right) = 0.25 \text{ h} \]

\[ v = \frac{d}{t} \]
\[ d = vt = (55 \text{ mi/h})(0.25 \text{ h}) = 13.75 \text{ mi} \]

Rel speed: \(70 \text{ mi/h} - 55 \text{ mi/h} = 15 \text{ mi/h}\) time to get ahead by 13.75 mi is:

\[ t = \frac{d}{v} = 13.75 \text{ mi} \left( \frac{1 \text{ hour}}{15 \text{ mi/h}} \right) = 0.9167 \text{ h} \]

Distance traveled: \(d = vt = 70 \text{ mi/h} \left( 0.9167 \text{ h} \right) = 64 \text{ mi} \)

6. A car traveling in a straight line has a velocity of +5.0 m/s at some instant. After 4.0 s, its velocity is +8.0 m/s. What is its average acceleration during this time interval?

\[ a = \frac{\Delta v}{t} = \frac{(8.0 \text{ m/s} - 5.0 \text{ m/s})}{4.0 \text{ s}} = 0.75 \text{ m/s}^2 \]
7. A car is traveling at 108 km/h, stuck behind a slower car. Finally the road is clear and the car pulls over to make a pass. The driver stomps on the gas pedal and accelerates up to a speed of 135 km/h. If it took 3.5 s to reach this speed, what is the average acceleration?

\[ a = \frac{\Delta v}{t} \]
\[ a = \left( \frac{135 \text{ km/h}}{3.5 \text{ s}} \right) \left( \frac{1000 \text{ m}}{1 \text{ km}} \right) \left( \frac{1 \text{ h}}{3600 \text{ s}} \right) = \frac{2.14 \text{ m/s}^2}{1} \]

8. A position vs time graph is shown to the right. Please analyze the graph and determine the following. (a) The speed of the object from b → c, (b) the speed from c → d, (c) the speed from d → e, (d) the times \( t \) when the speed of the object is zero, and (e) the points where the direction of the object had to change (if any).

(a) \( v_{bc} = 0 \)
(b) \( v_{cd} = \frac{-5 m - 4 m}{7 s - 5 s} = -4.5 \text{ m/s} \)
(c) \( v_{de} = \frac{0 m - (-5 m)}{15 s - 7 s} = 0.62 \text{ m/s} \)
(d) b – c,
(e) (maybe) a, c, d, (maybe) e

9. You walk down the sidewalk to the east for 8.0 min at a speed of 1.2 m/s. You reach a busy street and have to stop. You remain at rest for 2 minutes. The traffic dies down, so you run across the street at constant speed. The street is 12 m wide and it takes you 1.5 s to cross it. You immediately slow down to your regular 1.2 m/s walk speed and proceed for 2 min. You suddenly discover that your plush ducky fell off your backpack. You immediately turn around and run back to the intersection you just crossed. You run at a constant speed of 6.5 m/s. Make a distance vs time graph for your motion.

\[ v = \frac{x}{t} \]
\[ x = vt \]
\[ 1.2 \text{ m/s} \left( 8 \text{ min} \right) \left( \frac{60 \text{ s}}{1 \text{ min}} \right) = 576 \text{ m} \]
\[ x = 1.2 \text{ m/s} \left( 2 \text{ min} \right) \left( \frac{60 \text{ s}}{1 \text{ min}} \right) = 144 \text{ m} \]
\[ 576 \text{ m} + 12 \text{ m} + 144 \text{ m} = 732 \text{ m} \]
\[ v = \frac{x}{t} \]
\[ t = \frac{x}{v} \]
\[ 144 \text{ m} \left( \frac{1 \text{ min}}{6.5 \text{ m/s}} \right) \left( \frac{1 \text{ min}}{60 \text{ s}} \right) = 0.37 \text{ min} \]